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AUTHOR Bandi, Rajendra; Nakatani, Kazuo
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ABSTRACT

The emergence of newer World Wide Web-based technologies has resulted in increased offering of distance education courses in most academic areas. However, to a great extent, the choice of technology is governed by the availability of technology rather than by the appropriateness of the technology for the course being taught and for the learning outcomes. Although the importance of IT (Information Technology) in education is realized, a literature review shows that there is some disagreement on effectiveness of IT as a main educational tool, requiring further empirical studies. This paper discusses an ongoing empirical research in Web-based distance learning strategies that aims to identify the relationships between the course variables, student variables, instructor variables, and the appropriateness of the technology for the learning objectives. The research used the survey method, collecting data from two target populations: students who have taken distance learning IS (Information Systems) courses and faculty who have taught distance learning IS courses. Existing technologies for distance education have been identified and categorized as follows: (1) one-to-one (personal) communications; (2) one-to-many single media communications; (3) one-to-many one-way multimedia education/teaching; (4) educational software; (5) testing and evaluation; (6) multimedia discussion; and (7) single-media discussion. The survey forms are appended. (Contains 29 references.) (MES)

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WEB-BASED DISTANCE LEARNING: CHOOSING EFFECTIVE TECHNOLOGIES FOR INFORMATION SYSTEMS COURSES

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Rajendra Bandi
Florida Gulf Coast University

Kazuo Nakatani
Florida Gulf Coast University

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The emergence of newer web-based technologies has resulted in increased offering of distance education courses in just about every academic area. However to a great extent the choice of technology is basically governed by the availability of technology rather than by the appropriateness of the technology for the course being taught, and for the learning outcomes. Although the importance of IT in education is realized, literature review shows that there is some disagreement on effectiveness of IT as a main educational tool, requiring further empirical studies. In this paper we discuss our ongoing empirical research to identify the relationships between the course variables, student variables, instructor variables and the appropriateness of the technology for the learning objectives. Existing technologies for distance education have been identified and categorized. Survey instruments for IS students and faculty have been developed.

INTRODUCTION

Distance education has existed in the academia for many years, but they have traditionally been in subjects which do not demand a strong interaction between the students and the teacher. However the newer technologies involving the Web and multimedia show promise in supporting interactivity. Today we have a plethora of instructional delivery options using the Internet, in addition to the traditional distance learning technologies such as videotapes or audiotapes. Successful offering of distance learning requires a careful selection of technologies based on their appropriateness for the learning objectives for the course modules.

We have begun to see distance education courses being offered in just about every academic area. Today, there are a wide variety of technologies available to deliver instructions. These range from the simple plain text at one end to compressed video at the other extreme. They differ in the extent of interactivity supported, richness of the material presented, and the extent of asynchronousness supported in time and place.

What does this imply for the role of the professor and the student? One thing is sure that, the days of professors holding sway in a lecture maybe on the decline as universities move to electronic presentations and remote access for students. But are we (the professors) simply doing the same job via a different medium, or is the very nature of the job changing? The answer is yes to both. It is our contention that to a great extent, faculty are doing the same job using the same paradigm but via different medium. The choice of technology is basically governed by the availability of the technology. Missing from this picture is any evaluation of the appropriateness of the technology for the learning objectives that are the real essence of any teaching. The nature of the job itself is changing. Traditionally the role of faculty has been that of content provider, while the function of media design was that of the publisher. In web-based learning, the faculty's role includes that of a content provider as well as media designer where (s)he has to think of how the student accesses and uses the content. It is in this context that the faculty has to evaluate and select from the various options available such as bulletin boards, chatrooms, groupware, real-time video, visualization, animation, etc.

Our focus in this research is Web-based distance learning for Information Systems courses. Information systems (IS) courses require a high degree of interaction between

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the faculty and students, and among the students. For example, learning a new software application is often accomplished with live demonstration by the professor, instead of the students going through a built-in tutorial by themselves. Also, IS courses require the students to work on projects as a group using complex software such as DBMS, CASE tools, etc., most of which are very expensive for students to buy. How then would we accomplish effective teaching in the distance education courses?

No one technology available today, would be able to meet all of the requirements of the teachers and students. Also, we don't have sufficient knowledge to make appropriate selection of technologies to maximize the quality of distance education.

This paper discusses an ongoing research in Web-Based Distance Learning strategies in a university explicitly mandated by the state to focus on distance learning. In the following sections, we discuss the literature review, the focus of the research and research methodology, and the work done so far; which includes identifying the existing technologies and a framework for classifying the existing technologies, and the survey developed to gather data from information systems faculty and students taking IS courses.

LITERATURE REVIEW

Laurillard published *Rethinking University Teaching* in 1993 to explain effective use of education technology for university education. Then, Leidner and Jarvenpaa (1995) identified factors that affect the effective use of information technology for management school education. Those factors include electronic classroom types, their principle pedagogical assumptions and theories of learning, types of information technologies, and characteristics of students. In this study, they have shown the theoretical relationship among those factors, providing us with a strong theoretical basis for empirical studies. Lawhead et al. (1997) also provided a lesson development evaluation framework for distance learning. The dimensions included in their framework are development cost, delivery costs, student costs, and sustainability and cost-effectiveness. Epstein and Madey (1997) also developed a framework that shows the relationship among factors that determine the appropriateness of information technology for distance learning.

Almstrum et al. (1996) provided a framework for evaluation of technology for Computer Science/Information Systems (CS/IS) courses, indicating tradeoffs among desired evidence, costs, and other constraints for several empirical study approaches and techniques.

Several researchers have conducted empirical studies regarding the effectiveness of IT as an education tool. Hiltz (1994) tested the Virtual Classroom, one of the most famous distance learning tools developed by the New Jersey Institute of Technology. Several empirical studies were conducted to evaluate IT as a supplemental tool for a traditional classroom CS/IS courses (Alavi, 1994; Clark and Scott, 1995; Jankowski, 1997; Randolph, 1997). Effectiveness of video-conferencing was also empirically studied by Alavi, et al. (1995) and Wheeler et al., 1995). Hadidi (1997) conducted an empirical study on interactive conferencing class supplemented by WWW. Hislop (1997) reported student's attitude towards asynchronous learning networks, characterized by their support of "anytime, anyplace" education. In short, those studies show that when IT is used as a supplemental tool to a traditional face-to-face or technology-based conferencing class, the effectiveness of IT support is recognized. Also, positive students' attitude towards IT as an educational tool has been recognized. However, there is some disagreement on the effectiveness of IT as a main educational tool, requiring further empirical studies.

One of the important aspect of the design, development, and delivery of learning is individual differences in learning styles (Sadler-Smith, 1996; Sadler-Smith, 1997). It is believed that characteristics of students affect the efficacy of learning (Anderson, 1993, Knowles, 1990). According to Dunn, Ingraham, and Deckinger (1995), several researchers suggest that matching individual's learning style and teaching method may improve the learner's performance. For example, computer-based collaborative learning may be effective for matured, motivated learners but it may not be true for less motivated and less matured learners (Hiltz, 1988). Sadler-Smith (1996) points out that when a learner's preferences match with the learning methods used, a favorable reaction could result in greater motivation, greater willingness to participate in learning according to Kirkpatrick's framework (1976). However, Leidner and Jarvenpaa (1995) point out that little is known about the prerequisites to the effective application of IT in learning environment. In distance learning, it is important for instructors to know which course module implemented in a specific technology is perceived by students as a better instructional material.

THE RESEARCH

In this section we discuss our exploratory empirical study

to identify the latent relationship between the independent variables described below and the appropriateness of the technology for the learning objectives of the IS course modules. These independent variables belong to three dimensions: course module variables, student variables, and instructor variables. Course module variables include: topics of module (which are categorized based on IS97), type of technology used, etc. Student variables include: demographic variables, learning styles, learning environmental preference, etc. Instructor variables include: demographic variables, attitude toward technology as educational tools, attitude toward distance learning, familiarity with technology, etc. Appropriateness of technology is measured as satisfaction level of students and instructors.

Research Methodology

The research is done using survey method, collecting data from two target populations: students who have taken distance learning IS courses; and faculty who have taught distance learning CIS courses. Technologies or tools currently available for distance learning have been identified through literature review, and web searches.

Existing Technologies

We identified technologies used in distance learning by searching the existing literature (including journal and conference articles in the CIS and Distance Education fields) and the Internet (including distance course pages posted by universities and colleges, distance learning research pages, and software vendor pages). Many companies or universities implement the same technology as a specific product. Furthermore, a specific product often integrates several generic technologies. To generalize specific products implemented by a specific organization to generic technologies, we needed to apply a taxonomical framework. We used four criteria adopted from Hartley et al. (1996) to achieve this. Those four criteria are:

Type of communication (Hartley et al. Called this 'Uses')
- One-to-one
- One-to-many
- Many-to-Many

Time dimension on the delivery of educational contents (level of time-independence)
- Synchronous
- Asynchronous

Richness (Type) of Media Supported
- Text
- Audio
- Graphics
- Animation

Level of interactivity supported by technology
- Read-only
- Simple interactive
- Complex interactive
- Human interactive
- Intelligent/targeted tutorials

After we generalized specific products to more generic technologies, we grouped them using the same criteria for the purpose of developing a questionnaire. The technologies we identified are shown below. Some technologies appear in more than one category, because one technology could be used in many ways.

Category 1: 1 to 1 (Personal) Communications
Plain old telephone system
Internet telephony
e-mail (with Attachment)
Fax

Category 2: 1 to Many Single Media Communications
Audio publishing (Tape) and audio streaming
Hypertext
e-mail (withAttachment)

Category 3: 1 to Many 1-way Multimedia Education/Teaching
Business television (BTV)
Cable and public television
Videotape
Full motion video
Compressed video
Hypermedia
Tutorials
Video on WWW and streaming
Animation
e-mail attachment

Category 4: Educational Software
CD-ROM
Video disk
Computer-aided instruction
Tutorials
Visualization software
Virtual reality

Category 5: Testing and Evaluation
Hypertext

On-line quiz
Computerized grading

Category 6: Multimedia Discussion
Audiographics
Videoconferencing
Desktop videoconferencing
Application/File sharing
Web-enabled application software
Groupware
Whiteboard (graphics conferencing)
Web-enabled CASE
Web conferencing

Category 7: Single-media Discussion
Audioconferencing
Chatroom
Electronic bulletin boards
Whiteboard (graphics conferencing)
Newsgroups
Mailing lists (e.g. listserv)

Category 1: 1 to 1 (Personal) Communications: This type of technologies/tools mainly supports communications between an instructor and individual students synchronously or asynchronously.

Category 2: 1 to Many Single Media Communications: This type of technologies/tools mainly helps an instructor provide information (announcement/lecture summary) to many students. This type of technologies/tools supports only single media such as voice only, text only, or image only. This type of technologies/tools does not allow synchronous interaction between participants.

Category 3: 1 to Many 1-way Multimedia Education/Teaching: This type of technology/tools mainly helps an instructor provide information (lecture) to many students. This type of technologies/tools supports multi-media such as a combination of voice, text and image. This type of technologies/tools does not allow synchronous interaction between participants.

Category 4: Educational Software: This type of technology/tools mainly help students learn the materials by interacting prepackaged software. This type of technologies/tools usually supports multi-media such as a combination of voice, text and image.

Category 5: Testing and Evaluation: This type of technologies/tools is primarily used for evaluating students performance.

Category 6: Multimedia Discussion: This type of technologies/tools supports communication, especially discussions, among participants synchronously and asynchronously. This type of technologies/tools supports multi-media such as a combination of voice, text and image.

Category 7: Single-Media Discussion: This type of technologies/tools supports communication, especially discussions, among participants synchronously or asynchronously. This type of technologies/tools supports single media such as voice only, text only, or image only.

Survey of the IS Faculty

Once the available technologies were identified and categorized, we then determined the course modules that were of interest for us in this research. Since there is a wide diversity on the IS courses offered by various universities, we have decided to select the list of the relevant courses from IS'97. IS'97 is a model curriculum for undergraduate degree programs in Information Systems. This curriculum is the result of the joint effort of ACM, AIS and AITP, and is endorsed by DSI, IAIM, SIM, IACIS and INFORMS-CIS. The course modules that were identified are:

1. Fundamentals IS/Personal Productivity
2. IS Theory & Practice
3. IT Hardware and Software
4. Programming, Data and Object Structures
5. Network & Telecommunications
6. Analysis & Logical Design
7. Physical Design & Implementation with DBMS
8. Physical Design & Implementation with Programming Environment
9. Project Management & Practice

The third activity involved in the survey development was identifying the learning outcomes and purposes for which a technology is used for the faculty. This list was created as result of the brainstorming of the authors and is based on the factors identified by Leinder and Jarvenpaa (1995). The list is shown below:

- To control pace and/or content of learning
- To disseminate knowledge
- To make course related announcements
- To substitute for classroom lectures
- To substitute for lab assignments/demos
- To facilitate students to create knowledge
- To motivate students and increase their interest
- To achieve conceptual/procedural learning

- To increase participation/attention/discussion
- To have students work on assignments
- To conduct testing and grading
- To provide students with feedback/help
- To encourage collaborative learning
- To have students make presentation

The final survey which is shown in appendix A (and is also available on the WWW at http://www.fgcu.edu/knakatan/webeducation/websurvey.html), seeks the participants responses on two aspects. First, if the participant has used technologies in a specific technology category, for a specific course for a specific learning outcome/purpose. The second aspect seeks to find the participant's perception of the appropriateness of a specific technology category, for a specific learning outcome, for a specific. At this time we are still receiving responses from the participants, and we welcome other IS faculty to participate in this study by visiting the web at http://www.fgcu.edu/knakatan/webeducation/websurvey.html.

Survey of the Students

A similar exercise was conducted to design and gather data from the students who have taken courses offered by a Computer Information Systems department. The courses involved were Introduction to Computers (one was a regular class room section and other was an Internet-based section), Database, Systems Analysis and Design. The survey for all the students has two parts: The first part determines the personal learning style preferences. This is common to all students and is based on the work done by Dunn et al. (1982). There are several competing learning theories and no one model has been universally accepted (Bostrom, Olfman, and Sein, 1990). Learning style can represent a very broad concept and individual's learning style can be measured using a variety of instruments. Those include: Learning style Inventory (Dunn, Dunn, and Price, 1975, 1979, 1981, 1985), and PEPS (Dunn, Dunn, and Price, 1982). Learning style inventory is design for grade school students and PEPS is designed for adult learners. According to Dunn et al. (1995), reliability and validity of PEPS was established by several studies (Kirby, 1979; Buell and Buell, 1987; Ingham, 1991; and LaMothe, Belcher, Cobb, and Richardson, 1991). The second part seeks to determine the students' perception on the appropriateness and usefulness of technologies utilized during the class. Since different technologies were employed in the different sections, this part of the questionnaire differs according to the section. A sample survey form is shown in appendix B.

RESULTS

This research on completion is expected to result in:

1. A comprehensive list of technologies currently available for distance learning.
2. A list of factors to be considered when you design distance learning course for Information Systems.
3. Appropriate and inappropriate match-up between tools and course modules measured in terms of perceptions by instructors and students.
4. A list of characteristics of students which are more suitable or unsuitable for distance learning. This can be used to educate students so that they can succeed in distance learning environment.
5. A list of characteristics of instructors which are more suitable or unsuitable for distance learning. This can be used to educate or train instructors to be successful teachers.

SIGNIFICANCE OF THE RESEARCH

The research contributes to academia by empirically identifying factors to be considered for theory development in distance learning course design. This is critical to conduct theory-based research in evaluating appropriateness and cost-effectiveness of information technology as an education tool. The research also contributes to practitioners (instructors and software developers) by providing a framework that can be used as guidelines when they design courses or design computerized software tools for distance learning.

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APPENDIX A

SURVEY OF WEB-BASED/DISTANCE LEARNING TECHNOLOGIES/TOOLS FOR IS COURSES

Please fill out one survey form for each course you are currently teaching or have taught in the past. For each form (course), please do the following:

1. Select the course module (from the list given) which closely matches your course and circle it. These course modules are defined in IS'97. Please refer to an enclosed sheet for brief descriptions of each course module.
2. Circle (a) tool(s) you used listed for each technology/tool category. If you used any technology/tool that is not listed, please specify.
3. For each technology/tool category, check the "Used" column if you actually used this category of technology/tool for the listed learning goals/purposes. If you used it for other learning outcomes/purposes, please specify.
4. Then, for each technology/tool category, evaluate the level of the appropriateness to achieve the listed learning outcomes/purposes. Choose your responses from Highly Appropriate (HA), Appropriate (A), Neutral (N), Inappropriate (I), and Highly Inappropriate (HI). Please do this for all of the listed learning outcomes/purposes.

We have also enclosed a sample survey to provide clarification in filling out the survey form.

IS Course Modules Circle one course (The course modules correspond to IS 97 model curriculum)	1. Fundamentals IS/Personal Productivity 2. IS Theory & Practice 3. IT Hardware and Software 4. Programming , Data and Object Structures 5. Network & Telecommunications	6. Analysis & Logical Design 7. Physical Design & Implementation with DBMS 8. Physical Design & Implementation with Programming Environment 9. Project Management & Practice

Technology/Tool Categoryê	**Learning Outcomes/Purposes**	**Used**	**HA**	**A**	**N**	**I**	**HI**
Category 1: **1 to 1 (Personal) Communications** Plain old telephone system Internet telephony e-mail (w/ Attachment) Fax Other: _____	To control pace and/or content of learning						
	To disseminate knowledge						
	To make course related announcements						
	To substitute for classroom lectures						
	To substitute for lab assignments/demos						
	To facilitate students to create knowledge						
	To motivate students and increase their interest						
	To achieve conceptual/procedural learning						
	To increase participation/attention/discussion						
	To have students work on assignments						
	To conduct testing and grading						
	To provide students with feedback/help						
	To encourage collaborative learning						
	To have students make presentation						
	For other purposes: (please specify)						

Category 2:	To control pace and or content of learning						
1 to Many Single Media Communications	To disseminate knowledge						
	To make course related announcements						
Audio publishing (Tape)	To substitute for classroom lectures						
	To substitute for lab assignments/demos						
Hypertext	To facilitate students to create knowledge						
	To motivate students and increase their interest						
e-mail (w/Attachment)	To achieve conceptual/procedural learning						
	To increase participation/attention/discussion						
Other: _____	To have students work on assignments						
	To conduct testing and grading						
	To provide students with feedback/help						
	To encourage collaborative learning						
	To have students make presentation						
	For other purposes: (please specify)						

Technology/Tool Categoryê	Learning Outcomes/Purposes	Used	HA	A	N	I	HI
Category 3:	To control pace and/or content of learning						
1 to Many 1-way Multimedia Education/Teaching	To disseminate knowledge						
	To make course related announcements						
Business television (BTV)	To substitute for classroom lectures						
	To substitute for lab assignments/demos						
Cable and public television	To facilitate students to create knowledge						
	To motivate students and increase their interest						
Videotape	To achieve conceptual/procedural learning						
	To increase participation/attention/discussion						
Full motion video	To have students work on assignments						
	To conduct testing and grading						
Compressed video	To provide students with feedback/help						
	To encourage collaborative learning						
Hypermedia	To have students make presentation						
	For other purposes: (please specify)						
Tutorials							
Video on WWW							
Animation							
e-mail attachment							
Other: _____							
Category 4:	To control pace and/or content of learning						
Educational Software:	To disseminate knowledge						
	To make course related announcements						
CD-ROM	To substitute for classroom lectures						
	To substitute for lab assignments/demos						
Video disk	To facilitate students to create knowledge						
	To motivate students and increase their interest						
Computer-aided instruction	To achieve conceptual/procedural learning						
	To increase participation/attention/discussion						
Tutorials	To have students work on assignments						
	To conduct testing and grading						
Visualization software	To provide students with feedback/help						
	To encourage collaborative learning						
Virtual reality	To have students make presentation						
	For other purposes: (please specify)						
Other: _____							

Category 5: **Testing and Evaluation** Hypertext On-line quiz Computerized grading Other: _____	To control pace and/or content of learning						
	To disseminate knowledge						
	To make course related announcements						
	To substitute for classroom lectures						
	To substitute for lab assignments/demos						
	To facilitate students to create knowledge						
	To motivate students and increase their interest						
	To achieve conceptual/procedural learning						
	To increase participation/attention/discussion						
	To have students work on assignments						
	To conduct testing and grading						
	To provide students with feedback/help						
	To encourage collaborative learning						
	To have students make presentation						
	For other purposes: (please specify)						
Category 6: **Multimedia Discussion:** Audiographics Videoconferencing Desktop videoconferencing Application sharing Web-enabled application software Groupware Whiteboard (graphics conferencing) Web-enabled CASE Web conferencing Other: _____	To control pace and/or content of learning						
	To disseminate knowledge						
	To make course related announcements						
	To substitute for classroom lectures						
	To substitute for lab assignments/demos						
	To facilitate students to create knowledge						
	To motivate students and increase their interest						
	To achieve conceptual/procedural learning						
	To increase participation/attention/discussion						
	To have students work on assignments						
	To conduct testing and grading						
	To provide students with feedback/help						
	To encourage collaborative learning						
	To have students make presentation						
	For other purposes: (please specify)						

Technology/Tool Categoryé	Learning Outcomes/Purposes	Used	HA	A	N	I	HI
Category 7: **Single-media Discussion** Audioconferencing Chatroom Electornic bulletin boards Whiteboard (graphics conferencing) Newsgroups Mailing lists (e.g. listserv) Other: _____	To control pace and/or content of learning						
	To disseminate knowledge						
	To make course related announcements						
	To substitute for classroom lectures						
	To substitute for lab assignments/demos						
	To facilitate students to create knowledge						
	To motivate students and increase their interest						
	To achieve conceptual/procedural learning						
	To increase participation/attention/discussion						
	To have students work on assignments						
	To conduct testing and grading						
	To provide students with feedback/help						
	To encourage collaborative learning						
	To have students make presentation						
	For other purposes: (please specify)						

STOP HERE

THANK YOU VERY MUCH

APPENDIX B

A sample student survey form

	Questions: In-Class Course	Strongly Agree	Agree	Neutral	Dis-agree	Strongly disagree
Syllabus and Announcement						
1	Providing **Syllabus** on the course web page (HTML file), in addition to handouts, was useful.					
2	I like the fact that **Syllabus** was available on the course web page (HTML file) in addition to handouts.					
3	**Course Web Page** (HTML file) is appropriate for delivering the **Syllabus.**					
4	Providing **Announcements** on the Web Board, in addition to announcements in class, was useful.					
5	I like the fact that **Announcements** were provided on the Web Board, in addition to announcements in class.					
6	**Web Board is appropriate to make course Announcements.**					
Notes / Clarifications						
7	Providing **Notes (which explain "how to" use the software)** as Acrobat files (pdf files), in addition to in-class lectures, was useful.					
8	I like the fact that **Notes** (which explain "how to" use the software) was available as Acrobat files (pdf files), in addition to in-class lectures.					
9	Acrobat files (pdf files) are appropriate for delivering **Notes** (which explain "how to" use the software)					
10	Providing **instructions** (which explain "how to" use the software) as Microsoft Camcorder files, in addition to in-class lecture, was useful.					
11	I like the fact that **instructions** (which explain "how to" use the software) was available as Microsoft Camcorder files in addition to in-class lectures.					
12	Microsoft Camcorder files are appropriate for delivering **instructions (which explain "how to" use the software).**					
Homework						
13	Providing **Homework Assignments** on the course web pages, in addition to handouts, was useful					
14	I like the fact that the **Homework Assignments** were available on the course wen pages in addition to handouts.					
15	Course Web pages are appropriate for delivering **Homework Assignments.**					

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